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RESEARCH AND RECOVERY OF SNAKE RIVER SOCKEYE SALMON

ANNUAL REPORT 1992

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COLLECT AND REAR JUVENILE OUTMIGRANTS

Develop Holding and Rearing Facilities at Eagle, Idaho

Significant changes were made in the fish rearing facilities at the Idaho Department of Fish and Game's (IDFG) Eagle Hatchery during the contract period. An outside *rearing* area was enclosed with fence and chicken wire and covered with 70% shade cloth. Seven circular tanks were installed to hold the outmigrants in separate groups while the inside of the hatchery building was modified. The concrete vats were removed and a concrete floor with drains was poured. Twenty 2-mand eight l-m semisquare fiberglass tanks were installed. The original water supply and degassing tower were left intact since they have functioned well. The pump and back-up generator were serviced. Water level sensors were installed for the alarm system, which was linked to the local ADT Security Systems operator to call both staff telephone numbers and pagers. This system has worked well. No photoperiod control has been ueed to date. At this phase of the project, no attempt to control water temperature was installed. The other option was to move any maturing fish to Sawtooth Fish Hatchery to complete maturation. This was not necessary for the first year of the project. Project security has been increased at Eagle by having the fish culturist and one temporary employee live on-site. This also decreases response time in emergencies.

The second requirement for rearing juveniles was to design a rearing protocol and develop sampling protocols for genetics and pathology. The rearing protocol was derived with assistance of the Technical Oversight Committee (TOC), the scientific advisory group, and several fish culturists and nutritionists who were consulted informally. The standards were incorporated into the Research and Propagation Permit from National Marine Fisheries Service (NMFS), which was applied for during this project period (Appendix A). Pathology and genetics samples have been taken and processed from each fish which died during the rearing phase. These have been distributed in a timely manner to the appropriate laboratories at NMFS, University of Idaho, and IDFG.

Install and Operate Juvenile Traps at Redfish Lake Creek and Sawtooth Hatchery Weir

A Krey-Meekin trap was installed in Redfish Lake Creek from May 5 through June 4, 1991. A total of 861 smolts (Figure 1 and Table 1) were collected. Of these, 58 died due to turbulence in the trap. The remainder were held temporarily at Sawtooth Fish Hatchery and transported to Eagle Hatchery.

Trapping at Sawtooth Fish Hatchery (Figure 1) was done by the crew working on the intensive evaluation of smelt production. The period of operation was from February 28 to November 4, 1991. A total of 150 smelts were captured, with a loss of 7. The remainder were also transported to Eagle Hatchery.

Trap efficiencies estimated at the Redfish Lake trap by releasing 37 PIT-tagged smelts above the weir was 15%, giving a total run estimate *of* 4,500 smelts. Subsequent recovery at Lower Granite Dam of 57% gave an average travel time of 10.9 days for 10 fiBh and 17.9 days to Little Goose Dam for 11 fish.

Figure 1. Emigration timing of 0. nerka smolts from Redfish Lake 1991. **Numbers are estimates based on trap efficiencies (Kiefer** 1992).

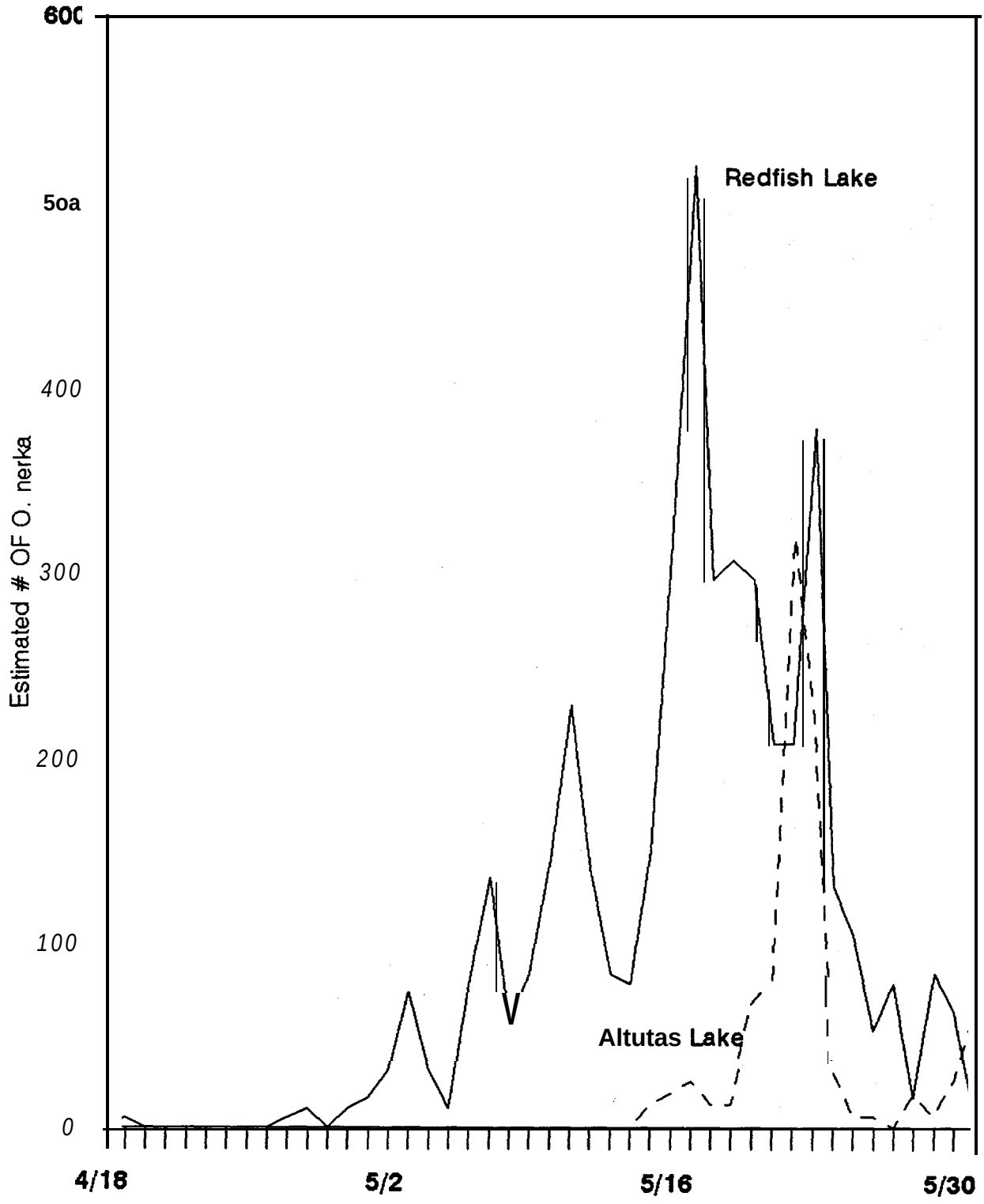


Table 1. Trapping and rearing mortalities for Redfish Lake sockeye outmigranta April 1991 to April 1992.

Stage	Cause	% of deaths/ final	% of final	Recommended solution
Trapping	Currents	58/861	6.7	New trap type with low velocity holding pen, check twice daily
Transport	Mechanical	7/759	0.9	Careful netting and crowding at Sawtooth Fish Hatchery
PIT tagging	Mechanical	4/759	0.5	
TOTAL		69/861	8.0	
Culture phase May-Dee 1991				
Jump-out		4/759	0.5	Better tank coverts
Fail to feed		2/759	0.3	
Bacterial Gill Disease		24/759	3.2	Lowerfeedrate, improve flushing
Other infections		6/759	0.8	Originated from wild stock
Handling loss at bleeding		13/759	1.7	
Undetermined		4/759	0.5	
TOTAL		50/759	5.3	

TABLES

Rearing of Juveniles

Five separate groups of Redfish Lake juveniles were formed from the seven deliveries of Redfish Lake outmigrants from Sawtooth Fish Hatchery. These have been kept separate throughout the first year at Eagle Hatchery. A custom diet for conversion of these wild fish to a hatchery diet was formulated with krill, blood worms, Biodiet pellets, premium cat food, and anchovy paste. This was used for the first two weeks of captivity, and was gradually reduced to krill and Biodiet pellets for another week, and finally to Biodiet alone. Overall survival for the year was 703 of 759, or 92.6% for fish which grew from 9.4 to 335 g mean weight (Table 2, Figures 2 and 3). Feed rates were set at about 70% of manufacturer's recommendations for salmon grown at 12°C. Feed size was kept slightly smaller than recommended, generally because sockeye favor small feed sizes.

The cause of death for each mortality was determined and is listed in Table 1. The main remedy for the loss has been to use tank screens which utilize the self-cleaning properties of the tanks to prevent bacterialgflldisease (BGD) to which sockeye are very susceptible. Two fish were diagnosed to be infected with bacterial kidney disease (BED) during the year. One died of BGD in October with a low level of BED infection, while the second died of BED in February. Erythromycin was given in the feed to all groups twice since BED was detected, but further mortalities are expected since Erythromycin will not eliminate the infection. The major challenge is to prevent the BED infection from spreading to the other groups of outmigrants 1991. Strict protocols have always been used to keep the five groups functionally separated, and to date, the infection has been restricted to group 4.

In a similar manner, outmigrants from the trapping at Sawtooth Fish Hatchery, which originated from Alturas Lake, were cultured at Eagle Hatchery. The results of this effort are shown in Table 3 and Figures 4 and 5. Originally, this group was incorporated to be able to test fish culture techniques with a group less sensitive to the issues of extinction. The Alturas Lake Q. nerka outmigrants may be considered as a potential for recovery similar to the Redfish Lake sockeye stock, and these fish may form the basis for a second captive broodstock.

Adult Trapping, Maturation, and Spawning

The adult trap on Redfish Lake Creek was operational from July 9 to October 1, 1991. The Sawtooth Fish Hatchery weir was operated from February 28 to November 4, 1991. No sockeye were trapped at Sawtooth Fish Hatchery weir, while four were captured in the Redfish Lake trap. These were all captured from August 11-25, 1991 (Table 4). They were transported to Sawtooth Fish Hatchery and held in well water until mature. Maturation events and sample distribution are listed in Table 4, while the egg numbers are listed in Table 5. A spawning matrix was recommended by NMFS and followed in these matings.

Incubation

Egg incubation to the eyed stage was performed at Sawtooth Fish Hatchery in Heath incubators supplied with well water. Fungus control was not necessary during that period. Once eyed, the eggs were picked and the sublots were divided equally, with half shipped to the Salmon Culture Research Laboratory of NMFS at Montlake, Washington, and half to Eagle Hatchery. Incubation at Eagle Hatchery utilized chilled well water at about 11°C (Table 7).

Table 2. Redfish Lake outmigrant 1991 size, growth, density, and feed data.

1991 Date	Event	Size (g)	No. fish	kg	Density kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
5/7-6/6	Delivery	9.4	766	7.2	0.92	2.7	1.5 grower			
6/91	Inventory	14.6	760	11.1	1.42	2.7				
6/16	Feed size change					2.7	2.5 grower	10.34	8.50	1.22
7/91	Inventory	24	756	16.1	2.33	2.7				
7/15	Transfer outside	35	756	226.5	3.29	2.7		18.44	9.03	2.04
8/91	Inventory	35	756	26.5	3.29	2.7				
								24.22	15.56	1.55
9/91	Inventory	65	755	49.1	6.10	2.7				
9/2	Feed size change					2.7	3.0 grower	54.84	22.76	2.41
10/91	Inventory	105	746	78.3	9.74	2.7				
10/2	Feed size change					2.7	4.0 grower			
10/27	Feed rate change					2.0				
11/5-11/25	ERY feed					2.0				
								368.43	169.71	2.17
12/91		205	728	149.2	18.56	2.0				
12/2	Feed size change					2.0	5.0 grower			
12/8	Feed rate change					1.3				
1/92		230	721	165.8	20.63	1.3	5.0 grower			
1/12	Feed rate change					1.0				

TAD3

Table 2. Continued.

1991 Date	Event	Size (g)	No. fish	ka	Density kc/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
2/92	Feed size change					1.0	6.0 grower			
3/92	Transfer inside									
3/92	Inventory	295	715	210.9	14.85	1.0				
4/92		355	703	235.5	16.56	1.0				
4/2	Feed rate change					1.5	6.0 brood			
								232.24	50.85	4.57
4/2-4/24	ERY feed					1.5				
4/25	Feed rate change					1.2				
5/92	Inventory	367	700	256.9	18.09	1.2				
								63.89	32.52	1.96
6/92	Inventory	427	700	298.9	21.05	1.2				
6/21	Feed rate change					0.8				
								177.12	87.70	2.02
7/92	Inventory	533	696	371.0	26.12	0.8				
8/92	Inventory	548	694	380.3	26.78	0.8				
								110.85	51.86	2.14
9/92	Inventory	625	690	431.3	30.37	0.8				
9/1	Feed rate change					0.6				
9/8-9/9	ERY Injectlon							71.77	31.17	2.30
9/22-9/29	Transfer outside									
10/92	Inventory	657	672	441.5	20.01	0.6				

TABS

Table 2. Continued.

1991 Date	Event	Sire (g)	No. fish	kg	Density kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
10/2-10/22	Group 1,2,3,5 ERY feed									
10/2-10/29	Group 4 ERY feed							156.50	47.30	3.31
11/92	Inventory	776	651	505.2	22.90	0.6				
12/92	Inventory	809	642	519.4	23.54	0.6				
1/93	Inventory	856	633	543.1	30.51	0.6		85.89	24.6	3.50

TABS

Figure 2. Redfish Lake outmigrant 1991 growth

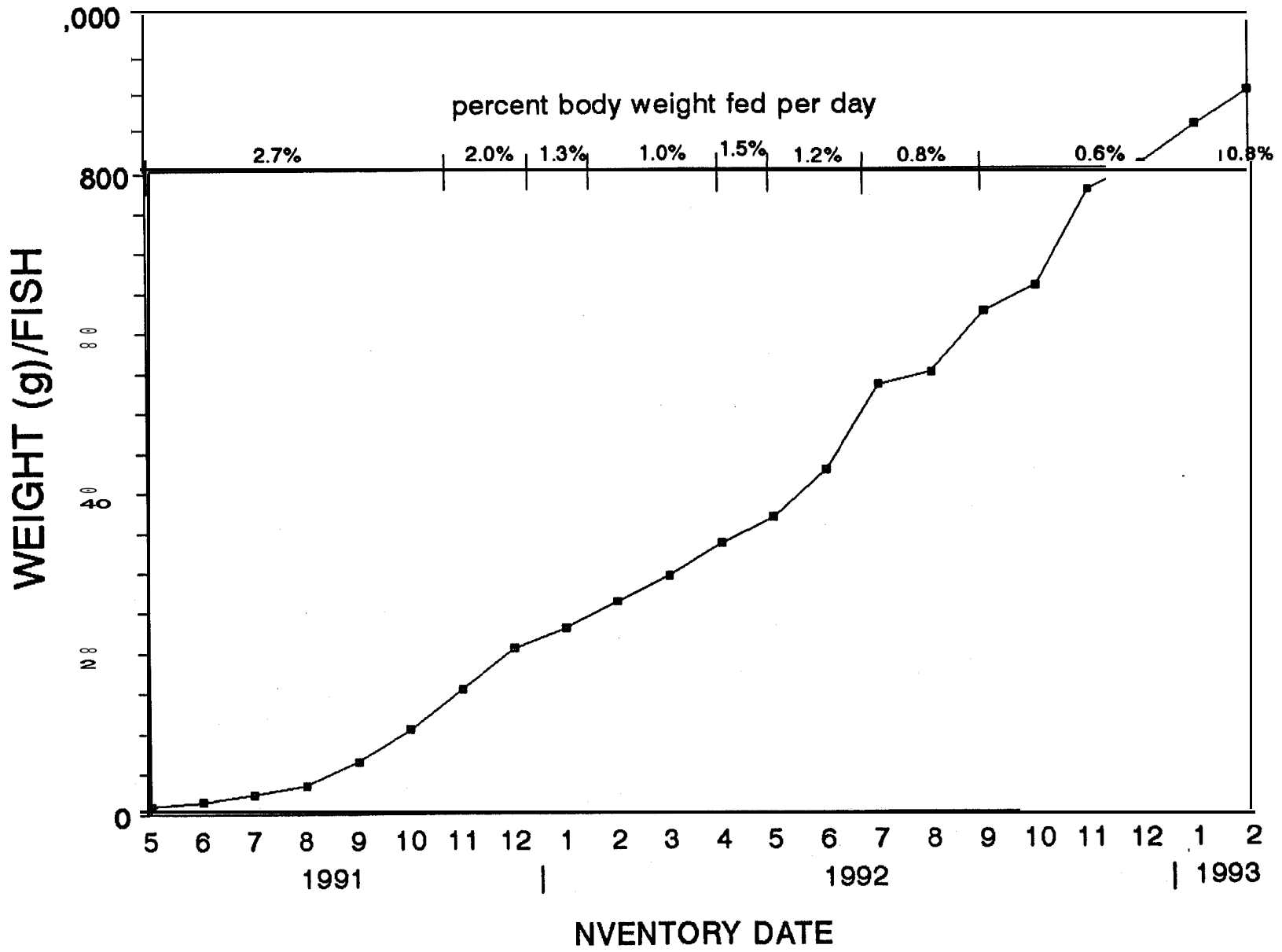


Figure 3a. Redfish Lake outmigrant 1991 Group 1,2,3,& 5.

Mortality by Month

Cumulative Mortality 5/91 -2/9/93 = 11.2%.

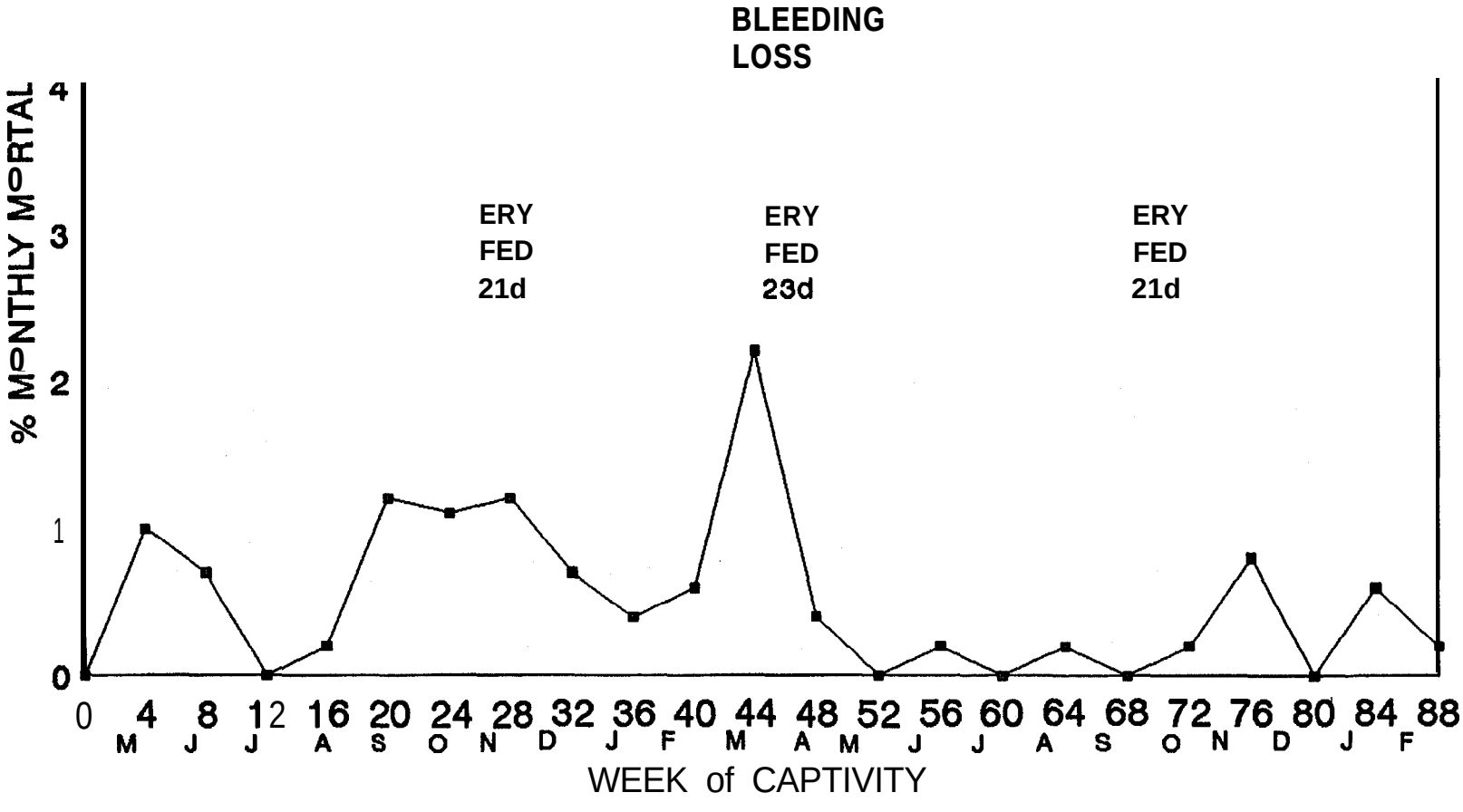
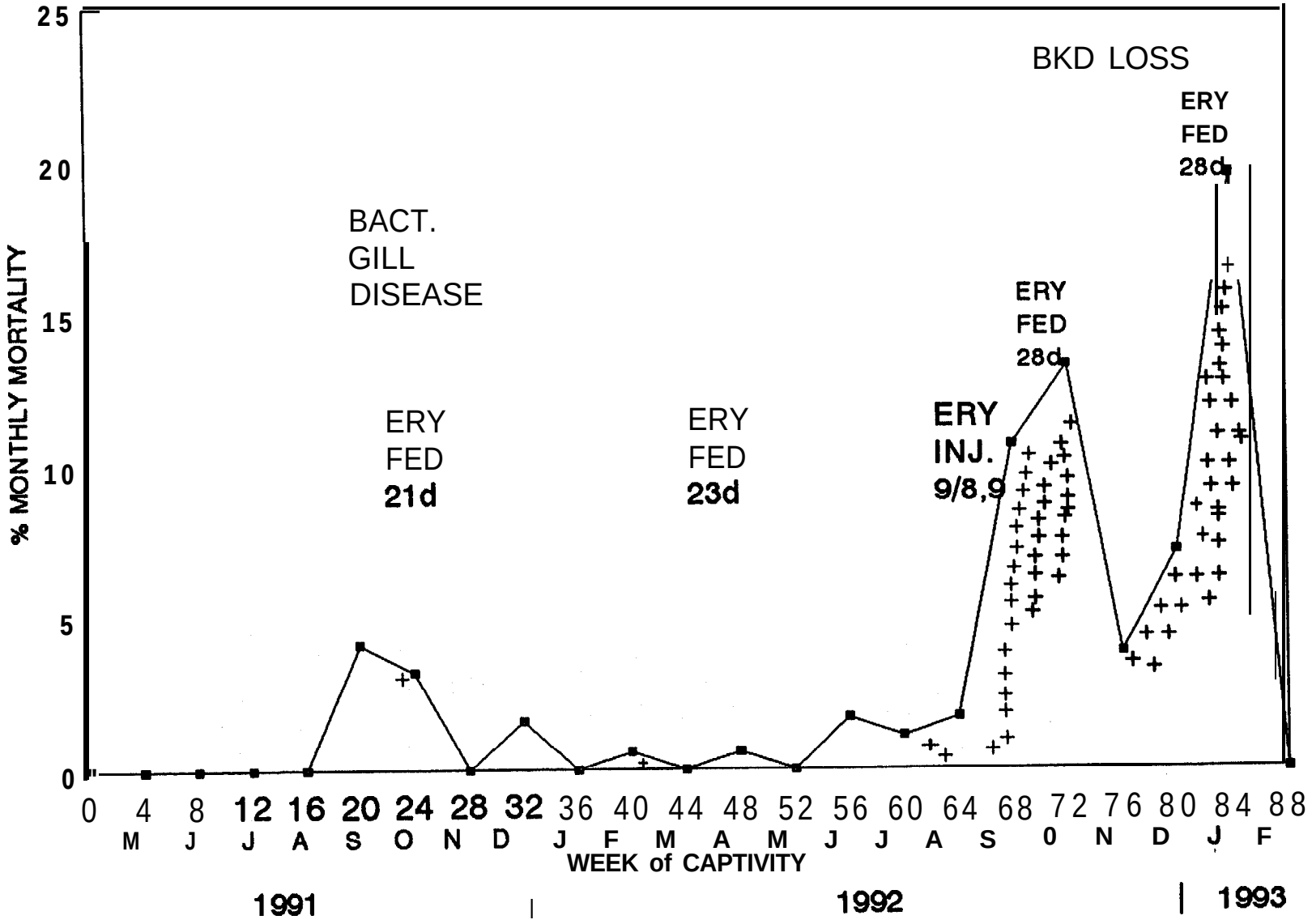


Figure 3b. Redfish Lake outmigrant 1991 Group 4.
Mortality by Month



Cumulative mortality 5/91-2/11/93 = 52%
+ = Mortality diagnosed BKD + by FAT

Table 3. Alturas Lake outmigrant 1991 size, growth, density, and feed data.

1991 Date	Event	Size (g)	No. fish	kg	Density kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
5/7-6/6	Delivery	6.8	144	1.0	0.63	2.7	1.5 grower			
6/91	Inventory	10	142	1.4	0.91	2.7				
6/16	Feed size change					2.7	2.5 grower	0.71	0.63	1.12
7/91	Inventory	14.6	141	2.1	1.32	2.7				
7/15	Transfer outside							2.12	1.30	1.63
8/91	Inventory	24	140	3.4	2.42	2.7				
9/91	Inventory	40	140	5.6	4.03	2.7		3.04	2.15	1.41
9/2	Feed size change					2.7	3.0 grower	7.14	2.51	2.84
10/91	Inventory	59	137	8.1	5.82	2.7				
10/2	Feed size change					2.7	4.0 grower			
1 D/27	Feed rate change					2.0				
11/5-11/25	ERY feed					2.0				
12/91		130	136	17.7	12.72	2.0		45.82	21.13	2.17
12/2	Feed slze change					2.0	5.0 grower			
12/8	Feed rate change					1.3				
1992-I 993										
1/92		160	136	21.8	15.65	1.3	5.0 grower			
TAD3										

Table 3. Continued.

1992-I 993 Date	Event	Size (g)	No. fish	kg	Denslty kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
1/12	Fesd rate change					1.0				
2/92	Feed size change					1.0	6.0 grower			
3/92	Transfer inside									
3/92	Inventory	230	136	31.3	11.01	1.0				
4/92		234	135	31.6	11.12	1.0				
4/2	Feed rata change					1.5	6.0 brood	27.78	2.66	10.85
4/2-4/24	ERY feed					1.5				
4/25	Feed rate change					1.2				
5/92	Inventory	238	135	32.1	11.31	1.2		7.70	8.22	0.94
6/92	Inventory	300	135	40.5	14.26	1.2				
6/21	Feed rate change					0.8		23.49	12.08	1.94
7/92	Inventory	350	133	46.6	16.39	0.8				
8/92	Inventory	396	131	51.9	18.27	0.8		15.24	3.67	4.15
9/92	Inventory	424	131	55.5	19.56	0.8				
9/1	Feed rate change					0.6				
9/3	Transfer to SFH					0.6	6.0 brood	15.30	10.54	1.45

TABS

Table 3. Continued.

1992-I 993 Date	Event	size (g)	No. fish	kg	Density kg/m	Fead rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
10/92	Inventory	509	130	66.2	4.97	0.6				
1 D/6-10/26	ERY feed					0.6		9.03	6.63	1.36
11/92	Inventory	525	129	67.7	5.09	0.6				
12/92	Inventory	560	129	72.2	5.43	0.6		11.36	10.00	1.14
1/8/93	Inventory	647	128	82.8	6.22	0.6				

Figure 4. Alturas Lake outmigrant 1991 growth.

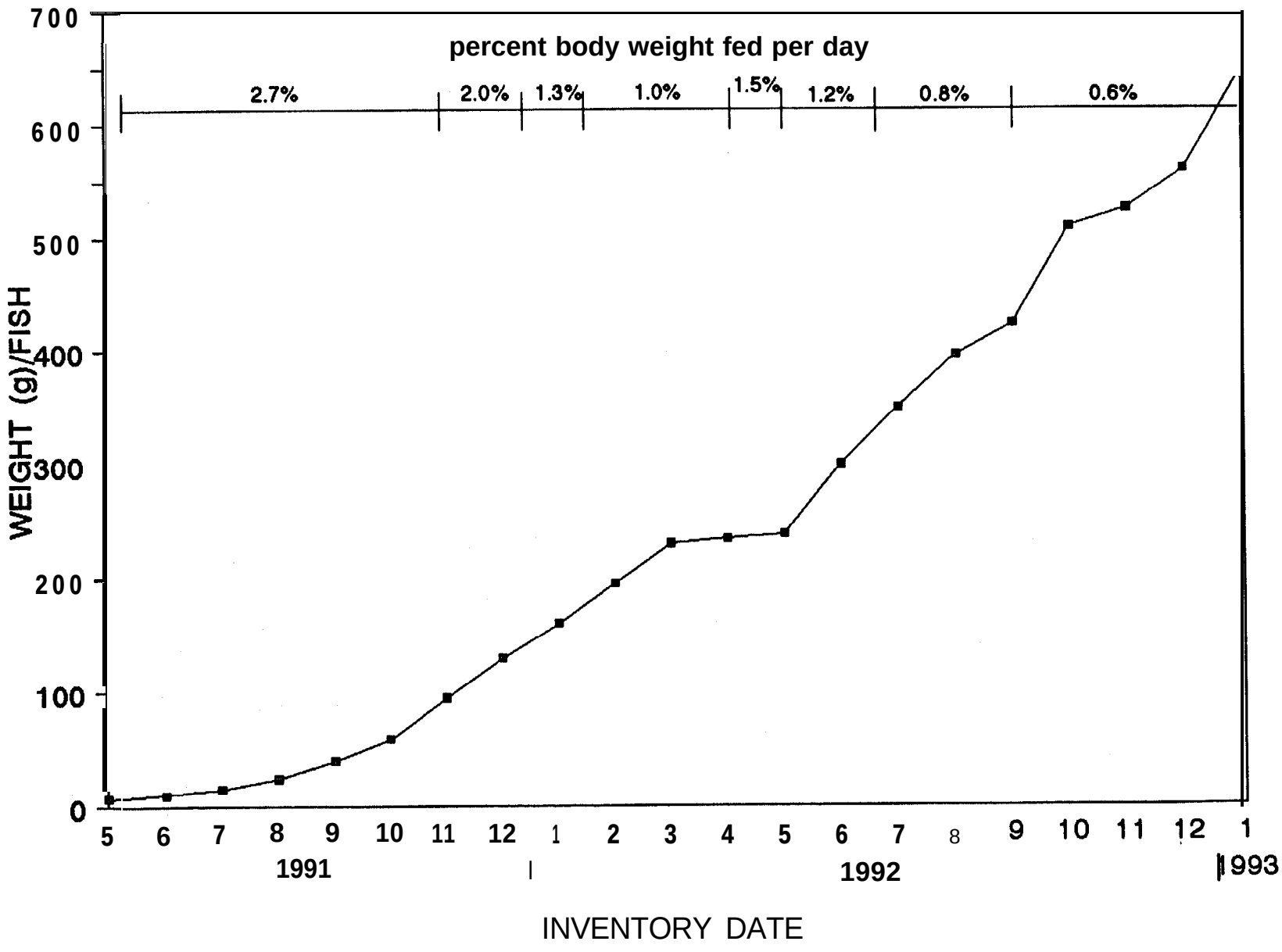


Figure 5. Alturas Lake outmigrant 1991 mortality by month.

Cumulative mortality 5/91-1/11/93 = 11.1%

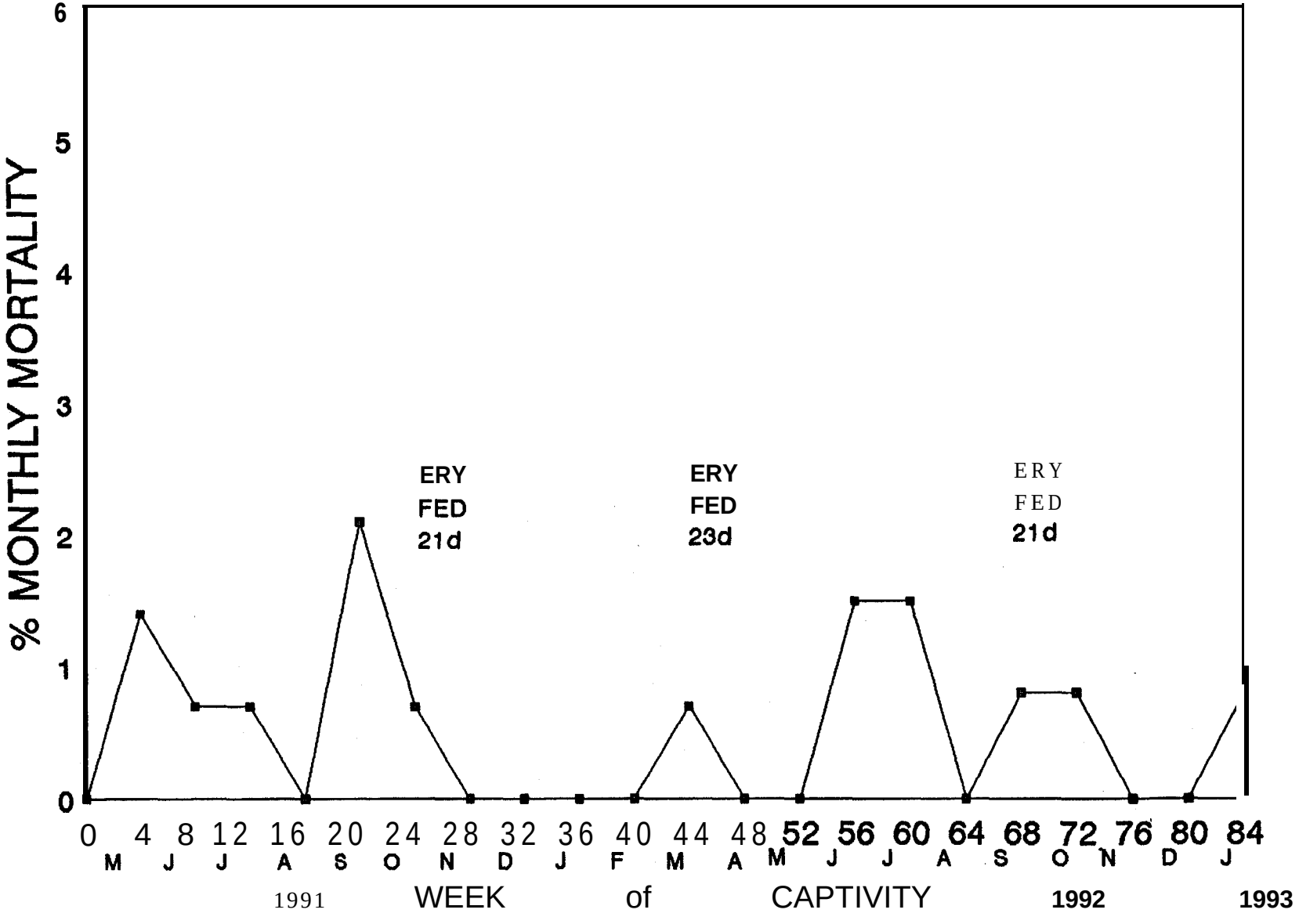


Table 4. Adult Redfish Lake eockeye salmon trapping and maturation events for 1991.

	lenath (cm)	weiahd (ka)	t e trapped
Male A -	56	1.6	8/15
Male B -	61	1.8	8/11
Male C -	55	1.6	8/24
Female	49.5	1.1	8/25

BATE

Sap 19 All fish non-mature but coloring well.

Sep 26 Female's egg mass enlarging but still anterior and hard. No milt form males.

Oct 3 Each fish anesthetized, weighted, and condition checked. Males were cold-branded as follows:

	Female	Male	Male B	Male C
Mark	none	*	**	• ⌧
Weight (kg)	1.1	1.6	1.8	1.6

Condition: Female darker and body cavity enlarging but still anterior and hard; gonadal pore enlarging slightly.

Oct 7 Male B: showed dilute milt; others none. Female: little change.

Oct 10 Female: enlarged slightly, egg mass still anterior and hard; gonadal pore enlarging slightly.
Male C: no milt.
Male A: a little dilute milt; harvest some next time.
Male B: harvested approximately 5 mg *of* milt (dilute) with some urine mixed. Motility check did not show motility at Sawtooth. Milt bagged, oxygenated, boxed, and sent with Brannon to UI/WSU for cryopreservation.

Oct 14 Female: egg mass enlarged (to ventral fin), but still pretty hard.
Males A and B: took 5 ml of milt from each; fairly motile (milt shipped for cryopreservation).

Oct 17 Female: egg mass further enlarged and softening.
Males A and B: sperm motile; approximately 5 ml from each (shipped for cryopreservation).
Male C: small milt volume; no milt taken.

Oct 19 Female: egg mass aoftening; loose eggs felt between vent and ventral fine.

Oct 20 Female: (noon) showed some gravel moved at lower end, (10:00 pm) gravel repositioned; no loose eggs at screen.

Oct 21 Few (15) eggs at screen. Male C had motile sperm on second sample. Express and incision spawned at 11:00 am. Observed female had lost egg volume and siphoned eggs from a 2 ft x 3 ft area of gravel (naturally spawned).

Table 4. Continued.

Groups as follow (numbers will be verified at eye-up):

	Expressed			Incision	Volitional
Male	A	B	C	ABC	
Volume (ml)	25	25	25	10	unknown
No. eggs	150	150	150	60	400

Approximate number of eggs = 900.
No milt cryopreserved on this date.
Female carcass transported to Eagle Lab. Pathology and genetic samples processed and frozen at -80%.

Oct 24, 28, and 31
Milt harvested from each male and sent to Cloud and Thorgaard's Lab for motility examination and cryopreservation. Milt was of poor quality on Oct 31. Decision made by Keith A. Johnson to terminate milt harvest.

Nov 3 All males terminated, blood drawn and frozen. Carcasses were transported to the Eagle Lab where pathology and duplicate genetic samples were processed; remaining carcasses were frozen. Adult samples distributed from each adult as follows:

Brannon-UI	Blood (5 or 6 vials each), duplicate muscle.
Waples-NMFS	Eye, liver, heart, muscle, testes - duplicates.
Rieman-IDFG	Otoliths and scales.
Pathology IDFG	OF and milt, KSPCB, kidney, WD, FAT, mucus.
Pathology USFWS	OF and milt, KSPCB.

Table 5. Brood Year 1991 Redfieh Lake sockeye salmon egg numbers and survival by subfamily at Sawtooth Fish Hatchery.

	Good eggs	Bad eggs	Total eggs	% survival
Male *A*	220	0	220	100
Male B	235	5	240	98
Male C	227	8	235	97
Male ABC	169	16	185	91
Natural	1,127	170	1,297	87
TOTALS	1,978	199	2,177	91

Table 6. Incubation events for Brood Year 1991 Redfish Lake sockeye incubated at Sawtooth Fish Hatchery.

1) CTU to eye.

	10/21-10/24	10/25-11/12	11/13-11/18	11/19-11/24
Temperature	9.4	8.9	8.3	7.8
# days	3.5	19	6	6
CTU's	33.04	169.1	49.8	46.8

$E_{CTU\ to\ EYE}$ = 298.7 (299)

2) *Eggs* shipped on 12/3 at 364.1 CTU's; half to Eagle and half to NMFS at Montlake.

Subfamily	Eagle	Montlake	Eggs picked off at Sawtooth	Total
A	110	110	0	220
B	118	117	5	240
C	118	119	8	235
ABC	89	84	16	189
Natural	563	560	170	1,293
Total	*998*	*990*	Total Fecundity	2,177
% Eye-up	91.3			

3) Hatching (Eagle): Majority hatched 12/31/91 and 1/1/92 at 645 CTU's.

Subfamily	No. eggs	no. eggs (fry picked off	% hatch	Total 1/13/92
A	110	2	98.2	108
B	118	1	99.2	117
C	118	1	99.2	117
ABC	89	0	100	89
Natural	563	17	97.0	546
Total	998	21	97.9	977

TABLES

Table 7. Brood Year 1991 sockeye size, growth, density, and feed data.

1992 Data	Event	Sire (g)	No. fish	ka	Density kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
1/28/92	Inventory	0.15	955	0.14	0.20	ad lib	mash			
3/22	Inventory	0.96	937	0.90	1.36	3.5	#1			
4/1	Transfer to lm				0.60					
4/24	Feed size change					3.5	1/3 #1 2/3 1.3 grower	1.09	1.46	0.75
5/1	Inventory	2.52	937	2.36	1.12	3.5	1.3 grower			
5/16	Feed size change					3.5	1/2 1.3 grower 1/2 1.5 grower	1.21	0.67	1.80
5/31	Feed rate change					2.5				
5/31	Inventory	3.25	936	3.03	1.16	2.5	1.5 grower	3.09	3.76	0.82
6/29	Inventory	7.3	930	6.79	2.39	2.5				
6/29-6/30	PIT tagging							4.63	3.21	1.44
7/28	Inventory	10.8	927	10.01	3.52	2.5				
8/13	Feed size change					2.5	1/2 1.5 grower 1/2 2.5 grower			
9/1	Inventory	20.3	927	18.82	6.61	2.5				

Table 7. Continued.

1992 Date	Event	Size (g)	No. fish	ka	Density kg/m	Feed rate % bw/d	Feed size (mm)	Cumulative feed amount (kg)	Weight gain (kg)	Conversion
9/16	Feed size change					2.5	1/2 2.5 grower 1/2 3.0 grower	16.64	10.84	1.54
9/18	Feed size change					2.5	3.0 grower			
9/30	Inventory	32.00	927	29.66	3.47	2.5				
10/2-10/19	ERY feed					2.5		78.99	23.96	3.30
10/20	Feed size change					2.5	4.0 grower			
11/30	Inventory	58.10	927	53.86	6.32	2.5		40.34	20.27	2.00
12/29	Inventory	80.05	926	74.13	8.69	2.5				
2/1		102.4	925		11.1					

BROOD YEAR 1991 SOCKEYE REARING

Feeding was initiated at 1,050" Temperature Units with Biodiet mash as a starter diet. Growth and survival has been good for the contract period. This group averages 2 g in weight for 937 fingerlings (Table 7 and Figure 6). Subfamilies will be reared separately until they can be PIT-tagged, pooled, and separated for final rearing.

Cryopreservation of Gametes

Three male adult sockeye which returned in 1991 were not killed at spawning, as is usual for Pacific salmon, but they were retained so subsequent milt could be harvested for use in future years. Several harvests of milt were made from each male before and after the female was ready to spawn. The milt was flown to two laboratories for cryopreservation. The processes of freezing and storage were done independently by the University of Idaho and Washington State University. Once frozen, the efficacy of fertilization of this sperm was evaluated with kokanee eggs from Lake Coeur d'Alene. These results (Tables 8 and 9) indicated successful fertilization, but at a reduced level compared to unfrozen controls. These results are typical of cryopreserved milt.

LIAISON ACTIVITIES

Expert Consultation Committee

A group of technical experts were assembled for a project review meeting on July 24, 1991. This group consisted of experts in the fields of sockeye hatchery culture techniques, genetics, pathology, and release strategies. The composition, questions, and responses are given in Appendix B. This group forms the nucleus of expertise to be called upon, either formally *or* informally, for comment, suggestions, and critical review as future needs arise.

Technical Oversight Committee

Project staff has attended each monthly Technical Oversight Committee meeting since the project began. These meetings give the project direction to the captive broodstock program and its ancillary research projects.

Presentations

Presentations were given at the Alaska Sockeye Workshop and at the University of Idaho during the period covered by this report.

National Marine Fisheries Service Propagation Permit

This permit was written and applied for, and a response was received in July 1992. The permit details the conduit of the trapping and culture of juveniles, the trapping and spawning of adults, and the culture of the resulting progeny.

91BPARPT

Figure 6. Redfish Lake brood year 1991 growth.

1/28/92-12/29/92

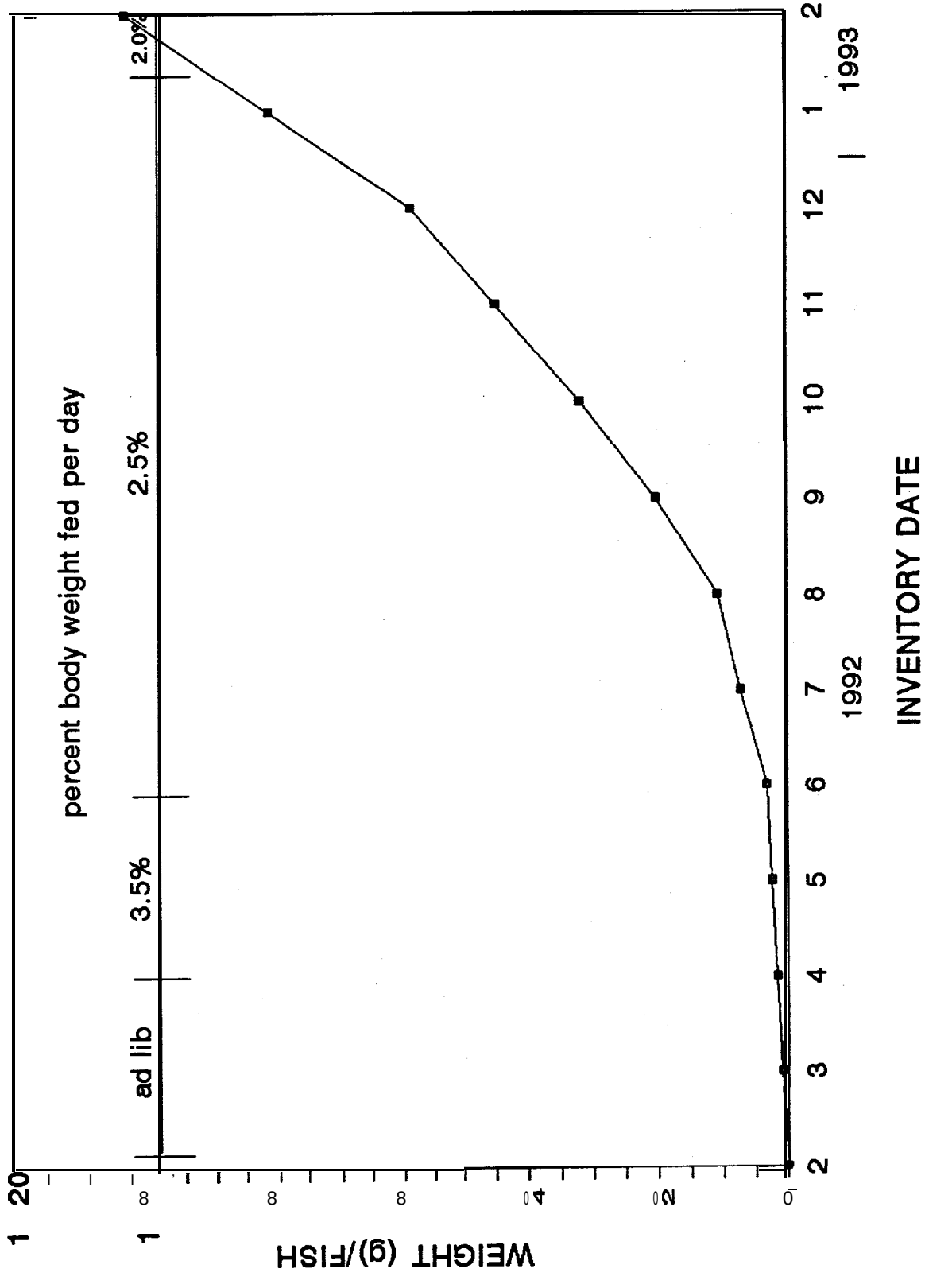


Table 8. Redfish Lake sockeye semen cryopreservation at Washington State University, 1991:

REDFISH LAKE SOCKEYE SEMEN CRYOPRESERVATION

Paul Wheeler and Gary Thorgaard
Department of Zoology
Washington State University
Pullman, WA 99164-4236
Phone: (509)-335-7438
Fax: (509)-335-3517

Fertility Trial:

Eggs from five L.Coeur D'Alene kokanee were pooled, split into six batches (141-202 eggs per batch) and used in fertility trials on December 5, 1991. One batch was fertilized with fresh, pooled semen from three L.Coeur D'Alene kokanee males as a control. Two straws of cryopreserved semen from sockeye males A and B were thawed and single straws were used to fertilize batches of eggs. One straw from each individual contained semen with relatively good pre-freeze motility; the other contained semen showing no pre-freeze motility. All semen from male C was immotile so only one straw was tested.

Results:

Batch #	Semen source (date frozen)	eyed/total	%	rel%
1	control —	171/185	92.4	—
2	Male A, 80% mot. (10/25)	68/202	33.7	36.5
3	Male A, 0% mot. (10/17)	0/158	0.0	0.0
4	Male B, 50% mot. (10/17)	42/143	29.4	31.8
5	Male B, 0% mot. (10/29)	2/141	1.4	1.5
6	Male C, 0% mot. (10/29)	0/152	0.0	0.0

Current Inventory, all 0.5ml straws:

Freeze date	Male	Pro-freeze motility % test.)	# straws
10/14	A	10	20
	B	50	20
10/17	A	0	19
	B	50	17
	C	0	4
10/25	A	80	9
10/29	A	80	20
	B	0	18
	C	0	19
11/1	A	50	20

Samples from males B and C shipped on 10/25 were frozen on arrival and none were cryopreserved. Semen from these same males shipped on 11/1 showed no motility and were heavily contaminated. These samples were also not cryopreserved.

Table 9. Fertility of cryopreservation of Redfish Lake sockeye at University of Idaho, 1991.

Fertility of Cryopreserved Redfish Sockeye Sperm

Source of sperm	N[a]	Percent Eye-up
Kokanee/Nonfrozen	149	973
Kokanee/Frozen (Oregon)[b]	153	45.7
Male A (10/17)[c]	148	0.0
Male B (10/17)	160	45.6
Male C (10/17)	96	54.2
Male B (10/14)	107	29.0

[a]N = number of eggs fertilized
[b](Oregon) = sperm derived from a Kokanee population and previously frozen using the identical procedures.
[c]Date = date of shipment

STAFFING

During the contract period, the sockeye program has been staffed as follows:

Keith Johnson, Fish Pathologist, started with the program from its inception.

Ryan Johnson, Fish Culturist, was hired shortly after fish deliveries began at Eagle Hatchery. Ryan lives on-site in the culturist house, which was renovated from office space.

Two temporary fish technicians were hired. One each are stationed at Eagle Hatchery and Sawtooth Hatchery for fish culture and trap tending duties. These are typically eight-month positions.

Office space has been provided by renovation of the former break room in the hatchery office/storage building. Additional off ice space is being built for the biologist at Nampa Fish Hatchery.

A P P E W D I C E S

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmorphrric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

JUL 29 1992

Mr. Steven Huffaker
Bureau of Fisheries
Idaho Department of Fish and Game
600 South Walnut Street
Boise, Idaho 83707

Dear Mr. Huffaker:

Enclosed is Permit No. 795, which replaces emergency Permit No. 776, issued to Idaho Department of Fish and Game under the authority of the Endangered Species Act of 1973. The emergency permit was effective until issuance of this permit or July 31, whichever came first. Permit 795 authorizes the taking of Snake River sockeye salmon (Oncorhvnchus nerka) for the purposes of research on and enhancement of the species. It is required that you review and comply with the Permit and the Conditions attached thereto prior to and while engaging in the activities authorized by the Permit.

Some differences exist between this Permit and the emergency Permit. Due to comments and concerns by reviewers, an additional condition has been added that requires that IDFG, in conjunction with NMFS Coastal Zone and Estuarine Studies Division, develop a decision tree to direct the spawning of the captured outmigrants and the possible release of their progeny should no viable solution to the problem of differentiation between sockeye and kokanee be found.

We have granted your request for a five-year permit. Work in each succeeding year will he contingent upon submission and approval of a report on each preceding year's activities and the specific research/enhancement activities proposed for the forthcoming year.

As a reminder, please note also that this permit does not authorize the release of progeny from sockeye spawned in captivity. We suggest that approximately six months from the time you hope to release these captive-reared fish, you submit a request to modify your permit to allow this activity. At that time there may be more data available with which to determine the best manner in which to handle the release.

Appendix A. National Marine Fisheries Service Research and Propagation Permit.

The fee for this permit is $25. Please make your check payable to the National Oceanic and Atmospheric Administration and mail it to: Chief, Permits Division, Office of Protected Resources, National Marine Fisheries Service, 1335 East-West Highway, Room 7324, Silver Spring, MD 20910.

Sincerely,

/Nancy Foster, Ph.D.
Director
Office of Protected Resources

Enclosure

Appendix A. Continued.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1335 East-West Highway
Silver Sprung. MD 20910
THE DIRECTOR

Permit No. 795
Expiration Date: July 31, 1997

Permit to Take Endangered Species

The Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, ID 83707, is hereby authorized to take the **endangered** species specified below for scientific research and enhancement purposes, subject to the provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543), the regulations governing endangered fish and wildlife (50 CFR Parts 217-222), and the Conditions hereinafter set out.

Abstract:

This Permit is for the trapping of up to 20 adult and 4500 juvenile Snake River sockeye in order to obtain individuals for **the purposes** of propagating this species in captivity and to tag juveniles. After tagging, up to 450 juveniles will be maintained for use as captive broodstock, while the rest will be released back into the river. The captive broodstock will help to perpetuate this species and provide supplies of Snake River sockeye for future recovery actions. Releasing tagged juveniles will provide information that will improve their survival through the hydroelectric system and aid in the development of a recovery plan for this species.

Authorization:

A. Number and Species of Animals

This Permit is for work to be conducted over a five-year period. Take numbers listed below are maximum numbers authorized per year.

1. Up to 20 adult Snake River sockeye salmon (Onchorhvnchus nerka) may be captured, measured, maintained, spawned and the resulting progeny reared by IDFG for use as broodstock.

2. Eggs and/or progeny of A.l. above may be transferred to the NMFS NWFSC's hatchery in Seattle, Washington and later returned to IDFG.

Appendix A. Continued.

3. Up to 4500 juvenile Snake River sockeye salmon (Onchorhvnchus nerka) will be captured over the course of the migration season (April 1 - June 15). All will be implanted with PIT tags for future monitoring purposes. Of these 4500, up to 450 will be retained and transferred to IDFG Eagle Hatchery for the captive broodstock program, and up to 50 will be released above Redfish Trap in order to make juvenile collection efficiency and abundance estimates. The remaining fish will all be released downstream of the collection site.

4. Trapping of outmigrants shall be conducted in such a way as to provide adequate coverage of the entire outmigration period. The number of outmigrants retained for use in the captive rearing program shall not exceed one half of the total number of outmigrants captured during any one collection period, or 450 overall.

5. Mortalities associated with trapping, transport, holding, tagging and releasing activities shall not exceed eight percent (8%) of the total number of fish taken.

B. Special Conditions

1. Research Requirements

a. The salmon shall be taken by the means, in the areas, and for the purposes set forth in the application, as limited by the terms and Conditions of this Permit.

b. The Holder (or designated agent) shall not intentionally kill or cause to be killed any sockeye salmon authorized to be taken. If mortalities in excess of those authorized in A.4. above should occur, the Holder shall immediately suspend activities, notify NMFS within 24 hours and submit a report to the Assistant Administrator for Fisheries describing the circumstances surrounding the mortalities. Pending review of these circumstances, NMFS may suspend activities or modify the Permit in order to allow these activities to continue.

c. Those juveniles which will not be maintained for the captive broodstock program shall be PIT tagged and released within 24 hours of capture.

d. An auxiliary water supply &hall be carried on any vehicle to be used for sockeye transport.

e. Locking lids shall be used on the fish traps, in order to provide security.

f. Prior to conduct of activities, IDFG shall establish a protocol for discussion and concurrence with NMFS, NWFSC, in the event of unpredictable incidents or emergency situations.

g. IDFG, in conjunction with NMFS Coastal Zone and Estuarine Studies Division, shall develop a decision tree to direct the spawning of the captured outmigrants and the possible release of their progeny should no viable solution to the problem of differentiation between sockeye and kokanee be found.

h. This Permit is valid for the activities authorized herein through July 31, 1997.

2. Report Requirements

a. Work in each succeeding year shall be contingent upon submission and approval of a report on each preceding year's activities and the specific research/enhancement activities proposed for the forthcoming year.

The report shall include, in tabular form, when, where and how many individuals were taken, including the actual number tagged, released, monitored, spawned or retained, and the number of animals injured or killed.

Additionally, the report shall include a brief narrative of the circumstances surrounding each injury or death, measures taken to minimize disturbance and the effectiveness thereof, a description of the effects of the activities on the subject species, and steps that have been and will be taken to coordinate the research with that of other researchers.

b. The Holder shall submit a final report within ninety (90) days of completion of the research summarizing the results of the research.

Appendix A. Continued.

c. These reports shall be submitted to the Assistant Administrator for Fisheries, National Marine Fisheries Service, Suite 7324, Silver Spring, MD 20910.

C. Karnella

William W. Fox, Jr.

JUL 2 9 1992

Date

Appendix A. Continued.

IDFG SOCKEYE RECOVERY CONSULTATION TEAM

Culture

Bob Burkett, ADFG-FRED, PO Box 3-2000, Juneau, AK 99802-2000 (907-465-4160)

Bill Halloran, SSRAA, 1621 Tongass Ave., Rm 103, Ketchikan, AK 99901 (907-225-9605)

John Burke, ADFG-FRED, PO Box 3-2000, Juneau, AK 99802-2000

Broodstock Maturation

Bill Hershberger, UW, Fisheries, WH-10, Seattle, WA 98195 (206-543-9880)

Bob Esselman, IDFG, 071 US Highway 20, Bellevue, ID 83313 (208-788-2847)

Ian Williams, DFO, Pacific Biol. Sta., PO Box 100, Nanaimo, BC Canada V9R (604-756-7095)

Physiology- Nutrition

Carl Schreck, OSU Coop. Fisheries Unit, Corvallis, OR 97331 (503-737-4531)

Gary Wedemeyer, USFWS, NFRC - Bldg 204, Naval Station, Seattle, Wa 98115-5007 (206-526-6282)

Gerry Bouck, BPA, Division of Fish and Wildlife-PJ, PO Box 3621, Portland, OR 97208-3621 (503-230-5213)

Ron Hardy, NMFSC, 2725 Montlake Blvd E., Seattle, Wa 98112 (206-553-7626)

Genetics

Chris Wood, DFO, Pacific Biol. Sta., PO Box 100, Nanaimo, BC Canada V9R 5K6 (604-756-7410)

Robin Waples, NMFSC, 2725 Montlake Blvd. E., Seattle, WA 98112 (206-553-1997)

Ernest Brnnnon, Aquaculture, Univ. of Idaho, Moscow, Id 83843 (208-885-5830)

Joe Cloud, University of Idaho, Moscow, ID 83843 (208-885-6388)

Jim Parsons, Clear Springs Trout Co., PO Box 712, Buhl, ID 83316 (208-543-8217)

Pathology

Keith Johnson, IDFG, 1800 Trout Rd., Eagle, ID 83616 (208-939-2413)

Ted Meyers, ADFG/FRED, PO Box 3-2000, Juneau, AK 99802 (907-465-4160)

Garth Traxler, DFO, Pacific Biol. Sta., PO Box 100, Nanaimo, BC Canada V9R 5K6 (604-756-7062)

Jim Winton, USFWS, NFRC - Bldg 204, Naval Station, Seattle, WA 98115-5007 (206-526-6587)

Engineering

Dave Owsley, Dworshak NFH, PO Box 18, Ahsahka, ID 83520 (208-476-4591)

Appendix B. Sockeye consultation meeting notes and attendees.

Meeting notes for July 24, 1991 of the sockeye Consultation Team the Idaho Department of Fish and Game sockeye recovery.

HISTORY OF REDFISH LAKE RUN AND CURRENT STATUS

Sue Broderick from Sho-Ban tribe described the run history in the last three years as being 4 fish for 1988, 2 fish for 1989, and no fish for 1990. She summarized the planned Sho-Ban efforts to include fertilization of the lake, barrier modifications and to insure that the amplification of the sockeye will be done in the nursery lakes consistant with the genetics issues that have been brought up.

ELECTROPHORETIC ANALYSIS OF STANLEY BASIN O.NERKA

The second item deals with the current status of the electrophoretic samples that are being done by the National Marine Fisheries Service. That presentation was given by Dr. Robin Waples. The fish for the kokanee portion of the samples from Redfish Lake were collected by Ernie Brannon and included four, five and six year old spawners taken from Fish Hook Creek in August, 1990. There was a total of 88 spawners, and 12 fish taken from trawls in Redfish Lake.

The Alturas kokanee consisted of 100 fish, all taken from the trawls. One thing Waples has mentioned is that both Redfish Lake kokanee and Alturas Lake kokanee are very similar to each other as far as their pattern but are different than other kokanee. The reason for running the samples is to make a determination whether or not the sockeye that were emigrating from Redfish Lake in 1991 were different from the kokanee that reside in Redfish Lake. aElectrphoretic analysis was made on a total of 65 Redfish Lake outmigrant sockeye. Waples said that in a preliminary look, emphasizing that the results are preliminary, that there were 9 polymorphic loci present in those fish and that 6 of the 9 showed a significant difference between the Redfish Lake samples and the adult kokanee samples. Of the 6, two of those loci showed a very large difference with the outmigrants to the kokanee. He concluded that on a preliminary basis there are two different gene pools of O.nerka in Redfish Lake. Those differences are based on genetics and have been maintained over a long period of time, probably because the kokanee spawn in August and early September and the sockeye spawn in October and also that the kokanee spawn in Fish Hook Lake Creek and other tributary streams while the sockeye are lake spawners (temporal and spacial segregation).

Appendix B. Continued.

REDFISH LAKE O.NERKA POPULATION SIZE

Bruce Rieman presented some information on the size of the **Redfish** Lake population. The trapping that was done this year demonstrated about four thousand outmigrant smolts and that is too many fish based upon the number of sockeye adults that returned to **Redfish** Lake two years ago. He said that the total population in **Redfish** Lake is about 8000 O.nerka of the age class that contributed the 4000 outmigrants.

Bruce Rieman had some data on the number of fish in **Redfish** Lake. He emphasized the total population of sockeye and kokanee in **Redfish** Lake as 64 fish per hectare, and of the number of emigrants that we saw that would equate to about 20 fish per hectare of surface. He felt the **Redfish** Lake historically produced tens of thousands of smolts.

The aging informationthathas been available so far indicates that the kokanee are spawning as four and five year old **fish** with a few six year old fish.

STATUS OF DNA DETERMINATIONS

Ernie **Brannon** indicated that now the samples are being stored up in Moscow. They are looking at the differences between Babine River sockeye and **Redfish** Lake kokanee, and they are seeing some promising results. But, still it's not at a point of being able to use them on the **Redfish** Lake outmigrant samples.

PHYSIOLOGICAL TESTING

As far as physiological testing of a non lethal 'nature there was a suggestion that the onset on sea water tolerance will not be a very good technique because the outmigrant sockeye that are **enroute** to the ocean have a long distance to spend **enroute.** There were very little difference as found by Chris Wood between sockeye and kokanee on their onset of sea water tolerance. They have the same pattern but just slightly differences in magnitude. The value of 70 milliosmols was the cutoff between smolts and non smolts and it was a matter of timing slightly between sockeye and kokanee but not one of magnitude. Gary Wedemeyer suggested that volitional smolt outmigration withthetemperature might be worthwhile looking at and suggested we talk to Ted Bruhn abut that. Gary also suggested that we look at gill ATPase. Using a non-lethal technique of snipping out a gill arch for that ATPase test.

Ernie **Brannon** indicated that behavioral criteria could also be used such as comparing temperature units to different events in hatching.

INCUBATION

There was very little discussion of a critique of the Clear Springs or CSI incubator except to emphasize that we have to be able to remove gas bubbles before they get into the incubator. Ernie **Brannon** suggested that we roll the eggs at least 10 days after fertilization to reduce fungus problems and a need for fungus treatments. 'Bill **Halloran** suggested the use of heath trays or divided heath trays. Bill prefers them because of their simplicity, a proven design and are pretty foolproof.

On the incubation systems it was also suggested that we might want to consider a down flow incubator.

COMPARTMENTALIZATION

Bill Halloran, Bob Burkett and John Burke all emphasize that it is not necessary to cull, ie, kill the eggs from fish that have high titers of IHN because they just simply have not seen successful vertical transmission in many of their Alaskan experiences. It's worth the risk keeping highly positives as far away from the other groups but they are not seeing very efficient transfer of IHN virus. They also emphasized that Ted Meyers may not agree with this.

Garth Traxler indicated that in their experience at Nanaimo bacterial kidney disease was a bigger problem for sockeye than was IHN.

PIT TAGGING

Nobody had any comments about trying liquid collagen to seal pit tagging wounds.

PROGRAM GOALS:

1. Size of presmolts. October **instroduction** of smolt sized fish.

Bill **Halloran** emphasized that if we are to be returning smolts or presmolts to **Redfish** Lake rather than consider putting smolts in at 2 grams in June that we should grow the fish in the hatchery until October or when the lake is starting to slow down (water temperatures are dropping) that we can expect to get a a lot higher percentage of outmigration because about **70%** of the loss of **smolts** in the lakes occurs during their first summer and that it would be more advantageous to maximize the use of smolts by growing them up to a larger size in the hatchery. In other words, growing them up

already to smolt size in the hatchery and then planting them in the lake in October and letting them outmigrate on their own the following spring. Another suggestion that Bill had was **double or** triple cropping the fish so that we could maximize the production of fish at Eagle and still be able to maximize the number of smolts that we could produce.

On the same topic, the one thing NMFS found in Auke Lake in Alaska was that when they put 12 gram smolts into the lake the average size of the fish coming out of the lake was 9 grams so there was some loss in weight.

2. Reanadromizing kokanee

Another program addition to consider was given by Bob Burkett. This would be to reanadromize the **Redfish** Lake kokanee as an alternative to the program. He indicated that the Japanese and New Zealanders are currently doing this successfully.

About reanadromizing kokanee, Dave Owsley said that in 1978 there was a large spill of kokanee out of Dworshak Reservoir and in 1990 there were a fair number of adult red fish that came back to Dworshak including some that came up their ladder.

ADULT HOLDING

It was also emphasized that we should continue to have contact with Tom Flagg of National Marine Fisheries Service who is in charge of the Cle Eleum project-in Washington. His number is 206-842-7181. They are currently planning on trapping fish at the Tumwater Dam on July 29 and 30. If we wanted to take a look at that it would be a good opportunity.

Jerry **Bouck** emphasized that in his experience with holding adult sockeye at different temperatures cold water holding **(9-10C)** was desirable. He emphasized the need to keep feeding those fish even though they are being held for maturation. However, at the warmer water temperatures **(14C)** the mucosal lining in the digestive tract was absorbed and feeding those fish is more deleterious than not feeding them.

FISH DIETS

It was emphasized in the technical oversight committee that we need to be concerned about the levels of testosterone in the diets. Stacia Stower has emphasized the need to use a diet that the steroids have been removed from because there is a lot of active steroids currently in production diets of all types. We **should** talk **to our** manufacturers about the use of a non steroid diet.